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A Rapid Colorimetric Assay for Direct Detection of Unamplified Hepatitis C Virus RNA Using Gold Nanoparticles

Authors : M. Shemis, O. Maher, G. Casterou, F. Gauffre

Abstract : Hepatitis C virus (HCV) is a major cause of chronic liver disease with a global 170 million chronic carriers at risk of developing liver cirrhosis and/or liver cancer. Egypt reports the highest prevalence of HCV worldwide. Currently, two classes of assays are used in the diagnosis and management of HCV infection. Despite the high sensitivity and specificity of the available diagnostic assays, they are time-consuming, labor-intensive, expensive, and require specialized equipment and highly qualified personal. It is therefore important for clinical and economic terms to develop a low-tech assay for the direct detection of HCV RNA with acceptable sensitivity and specificity, short turnaround time, and cost-effectiveness. Such an assay would be critical to control HCV in developing countries with limited resources and high infection rates, such as Egypt. The unique optical and physical properties of gold nanoparticles (AuNPs) have allowed the use of these nanoparticles in developing simple and rapid colorimetric assays for clinical diagnosis offering higher sensitivity and specificity than current detection techniques. The current research aims to develop a detection assay for HCV RNA using gold nanoparticles (AuNPs). Methods: 200 anti-HCV positive samples and 50 anti-HCV negative plasma samples were collected from Egyptian patients. HCV viral load was quantified using m2000rt (Abbott Molecular Inc., Des Plaines, IL). HCV genotypes were determined using multiplex nested RT-PCR. The assay is based on the aggregation of AuNPs in presence of the target RNA. Aggregation of AuNPs causes a color shift from red to blue. AuNPs were synthesized using citrate reduction method. Different sets of probes within the 5' UTR conserved region of the HCV genome were designed, grafted on AuNPs and optimized for the efficient detection of HCV RNA. Results: The nano-gold assay could colorimetrically detect HCV RNA down to 125 IU/ml with sensitivity and specificity of 91.1% and 93.8% respectively. The turnaround time of the assay is < 30 min. Conclusions: The assay allows sensitive and rapid detection of HCV RNA and represents an inexpensive and simple point-of-care assay for resource-limited settings.

Keywords : HCV, gold nanoparticles, point of care, viral load
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